

Carpal Tunnel Syndrome in Grocery Checkers

A Cluster of a Work-Related Illness

SCOTT BARNHART, MD, and LINDA ROSENSTOCK, MD, MPH, Seattle

Grocery checkers must use a high level of repetitive motion in the course of their work. We report a cluster of seven cases of the carpal tunnel syndrome felt to be due to the excessive use of repetitive motion. Each of the grocery checkers had no other identifiable risk factors, and hand pain, physical examination abnormalities and prolonged median nerve sensory latencies had developed that were consistent with the diagnosis of the carpal tunnel syndrome. This cluster of cases, the relation of the history of their disorder to time at work and a review of the literature suggest that grocery checkers, because of their excessively repetitive tasks, are at increased risk for the carpal tunnel syndrome.

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The clustering of cases with common workplace exposures may signal the presence of a work-related disorder. The recognition of clusters of cases has led to the identification of a number of work-related illnesses, including small-cell carcinoma due to exposure to bischloromethyl ether and neurogenic bladder due to exposure to dimethylaminopropionitrile.^{1,2} We report a cluster of seven cases of the carpal tunnel syndrome among grocery checkers and provide a brief review of the literature implicating repetitive motion as a risk factor for the development of this disorder.

The carpal tunnel syndrome is one of pain and weakness of the hands resulting from compression of the median nerve as it passes through the carpal tunnel. Untreated, it may result in chronic pain, weakness and significant impairment in the functioning of the affected hand.

As early as 1911, Ramsey Hunt raised the question as to whether atrophy of the median nerve could be associated with repeated flexion and extension at the wrist.³ Since that time several studies have associated the carpal tunnel syndrome with repeated wrist flexion and extension.⁴⁻⁶ This syndrome has also been associated with a number of other risk factors including hypothyroidism, rheumatoid arthritis, a history of gynecologic operations, the use of birth control pills, wrist fractures, acromegaly, diabetes mellitus, amyloidosis and neuromas.^{4,7}

There are more than 200,000 grocery checkers in the United States, and the retail industry employs more than 25 million workers. Grocery checking involves highly repetitive tasks. Checkers handle more than 500 items per hour and fill as many as 80 bags per hour. Over an eight-hour shift, they may handle more than 2,720 kg (6,000 lb) of groceries.⁸ This extraordinary use of repetitive motion may place grocery checkers at increased risk for a number of neurologic and musculoskeletal disorders including the carpal tunnel syndrome, tendinitis and low back pain. The cluster of seven

cases of the carpal tunnel syndrome among grocery checkers described below is felt to represent the consequences of the use of excessively repetitive motion among the members of this common trade.

Patients and Methods

In a retrospective review of 943 patients evaluated in the Harborview Occupational Medicine Clinic (Seattle), we identified 26 cases of diagnosed carpal tunnel syndrome. Among the 14 cases occurring in women, 8 were grocery checkers (7 of whom were members of the United Food and Commercial Workers Local 1105; membership includes about 1,800 female checkers). One case was eliminated from the discussion because of concomitant Raynaud's phenomenon, raising the possibility of a systemic illness unrelated to occupational exposure. The charts of the seven remaining patients were reviewed for demographic information, duration and type of work practice, clinical symptoms, physical examination abnormalities including Tinel's and Phalen's signs and nerve conduction velocity testing for the sensory latencies across the wrist. Tinel's sign was defined as pain or tingling in the hand following tapping over the median nerve at the wrist crease, and Phalen's sign was defined as pain or tingling in the hand following flexion at the wrist for a minimum of 60 seconds.

Results

A summary of the exposures for the seven cases reported below is given in Table 1. The mean age was 43 years, mean hours worked per week 32 hours and mean length in trade 12 years.

The presence of signs and symptoms and the results of electrodiagnostic studies are shown in Table 2. Four of the seven complained of night pain, and all had a positive Phalen's sign in the affected wrist. Each patient had an antidromic

From the Occupational Medicine Program, Department of Medicine, Harborview Medical Center, University of Washington School of Medicine, Seattle.

Dr Barnhart is an American College of Physician's Teaching and Research Scholar, and Dr Rosenstock is a Henry J. Kaiser Family Foundation Faculty Scholar in General Internal Medicine.

Reprint requests to Scott Barnhart, MD, Department of Medicine, Harborview Medical Center, 325 Ninth Avenue, Seattle, WA 98104.

TABLE 1.—Age and Exposure of 7 Grocery Checkers to Repetitive Motion Tasks

Case	Age, yr	Average Hours/Week	Years in Trade, Number
1	26	35	10
2	34	35	4
3	63	29	29
4	49	32	9
5	55	30	12
6	29	36	7
7	46	32	15
Total*	43±14	32±3	12±8

*± Standard deviation.

median nerve sensory latency that was greater than 2 standard deviations above the predicted normal of 3.2 milliseconds (standard deviation [SD] 0.2). In most of the cases, ulnar nerve sensory latencies were measured for comparison and, except for one case, were within the normal range.

Reports of Cases

CASE 1. The patient, a 26-year-old woman with ten years' employment as a supermarket checker, presented with a history of numbness and tingling in her right hand for one year that had become apparent and worsened following the introduction of an electronic checkout scanner in her store. The numbness and tingling were aggravated while she was at work, and she frequently was awakened at night with numbness and tingling in the affected hand. Her medical history was unremarkable, and she was taking no medications. The only abnormalities noted on physical examination were positive Tinel's and Phalen's signs on the right. Antidromic right median sensory latency was 5.3 ms, right ulnar sensory latency was 3.8 ms and left median sensory latency was 3.2 ms.

A diagnosis of a right carpal tunnel syndrome was made, and the patient was given a wrist splint that she wore 24 hours per day while continuing to work. After beginning to wear the splint, she noted a substantial decrease in her symptoms. Follow-up measurement of her right median sensory latency at one, two and six months has shown a decrease from 5.3 to 4.8, 4.2 and 3.5 ms, respectively.

CASE 2. A 34-year-old woman presented with pain, numbness and tingling in both hands, though more in the right than in the left, for about 16 months. She had worked as a supermarket checker for 4 years and for the past 18 months had been using an electronic scanning cashier. Her symptoms

tended to improve over weekends and vacations. The findings of a physical examination were remarkable for the presence of a Phalen's sign and the absence of a Tinel's sign in both hands. There was no evidence of thenar muscle atrophy and distal sensation was normal. Her right and left median sensory latencies were 4.0 and 3.2 ms, respectively, with normal ulnar sensory latencies. A diagnosis of a right carpal tunnel syndrome was made and she was given a wrist splint.

CASE 3. A 63-year-old supermarket checker who had retired two weeks previously presented with numbness and pain in both hands. The pain and numbness began almost 17 years earlier. The symptoms waxed and waned but recently had become much worse with the introduction of electronic scanners in her store and the attendant increase in the use of her hands. On physical examination she had mild atrophy of the thenar muscles, decreased vibratory sensation distally on the hands and feet, a negative Tinel's sign and a positive Phalen's sign bilaterally. Right and left median sensory latencies were 5.5 and 7.5 ms, respectively. Sensory latencies of the right and left ulnar nerves were 3.3 and 3.1 ms (normal, 3.2 ± 0.2 SD), respectively. A diagnosis of a bilateral carpal tunnel syndrome was made. She elected to have a surgical release of both flexor retinacula, resulting in resolution of her symptoms.

CASE 4. The patient, a 49-year-old supermarket checker, presented with complaints of pain and soreness in her hands, arms, neck and lower back. These pains were all aggravated by her work as a checker. In addition, she complained of her arms going numb at night for the past two years. Her medical history was remarkable for a bilateral tubal ligation in 1974, and on physical examination she had a positive Phalen's sign on the right. On nerve conduction velocity testing, she had a right and left median sensory latency of 3.9 and 3.2 ms, respectively. Right ulnar sensory latency was 2.8 ms. A diagnosis of a right carpal tunnel syndrome was made.

Treatment was begun with a cockup splint on the right hand for 24 hours a day. The patient was then taken off work for one month, during which her symptoms resolved entirely and her right median sensory latency decreased to 3.5 ms.

CASE 5. The patient, a 55-year-old checker, presented with pain in her left hand for two years. The pain was located in her first three fingers and was accompanied by intermittent numbness. Her job as a checker involved keying in the prices with her right hand and moving groceries with her left hand. No abnormalities were found on physical examination, with the

TABLE 2.—Signs, Symptoms and Median Nerve Sensory Latencies of 7 Grocery Checkers With the Carpal Tunnel Syndrome

Case	Involved Hand	Hand Pain or Numbness	Night Pain	Tinel's Sign	Phalen's Sign	Median Sensory Latencies, ms	
						Right	Left
1	Right	Yes	No	+	+	5.3	3.2
2	Right	Yes	No	—	+	4.0	3.2
3	Both	Yes	Yes	—	+	5.5	7.5
4	Right	Yes	Yes	—	+	3.9	3.2
5	Both	Yes	Yes	—	+	4.5	6.4
6	Left	Yes	Yes	—	—	3.7	4.4
7	Right	Yes	No	—	+	4.2	3.5

+ = positive, — = negative

exception of a positive Phalen's sign bilaterally. Nerve conduction velocity testing showed a right and left median sensory latency of 4.5 and 6.4 ms, respectively. The right and left ulnar sensory latencies were normal. A diagnosis of a bilateral carpal tunnel syndrome was made.

The patient was taken off work and both her arms were placed in cockup splints for 24 hours per day. After five months her symptoms resolved completely, and her right and left median sensory latencies were both 4.5 ms.

CASE 6. A 29-year-old checker presented for evaluation of pain and aching of her left hand. She worked approximately 8 hours per day, 30 to 40 hours per week. She presented for evaluation two months after the onset of her initial symptoms, with aching and tingling in her left hand. The findings of a physical examination were unremarkable. On nerve conduction velocity testing, she had a right and left sensory latency of 3.7 and 4.4 ms, respectively.

A left carpal tunnel syndrome was diagnosed, and she was treated with the administration of ibuprofen in addition to a cockup splint. She returned to work using the splint. After one month she indicated that her hand felt worse. She was taken off work, and her symptoms improved over six weeks. Follow-up nerve conduction velocity testing showed a decrease in the left median sensory latency from 4.4 to 3.7 ms.

CASE 7. The patient, a 46-year-old supermarket checker, presented with increasing pain and numbness and decreasing grip strength of the right hand over the past year. She frequently was awakened from sleep with pain in her right hand and had the recent onset of poor coordination of her right hand and decreased strength. Her history is remarkable for a rotator cuff tendinitis of her right shoulder two years previously, a right lateral epicondylitis one year previously and a bilateral tubal ligation in 1974. On physical examination she had mild right epicondylar tenderness and a positive Phalen's sign on the right.

Her right and left median sensory latencies were 4.2 and 3.5 ms, respectively, and right and left ulnar nerve sensory latencies were 3.4 and 3.2 ms, respectively. A diagnosis of a right carpal tunnel syndrome was made, and she was given a right cockup splint.

Discussion

The carpal tunnel syndrome is felt to be induced or aggravated by any process that compresses the median nerve as it passes through the narrow confined space of the carpal tunnel. Repetitive flexion and extension of the wrist and grasping motions of the hand are thought to repeatedly compress the median nerve between the tendons and carpal bones, leading to injury to the median nerve. These motions also place a person at risk for the development of tendinitis and the accompanying swelling of the synovial sheath within the carpal tunnel with secondary compression of the median nerve.⁹⁻¹²

Analysis of sequential histologic sections of cadaveric wrists has shown evidence of vascular, connective tissue and nerve damage that is greatest in the carpal tunnel and less pronounced proximally and distally.⁹ Intraoperative measurement of carpal tunnel pressures in patients with the syndrome compared with controls has shown significantly greater pressures in those with the carpal tunnel syndrome.¹⁰ Evaluating the canal pressures in cadaver forearms has shown that flexing the wrist and loading the flexor tendons can cause pressures of

as great as 400 mm of mercury in the space occupied by the median nerve as it passes through the carpal tunnel.¹¹ These studies supported the biological plausibility of associating the carpal tunnel syndrome with repeated trauma.

Several studies of other occupations have also shown the association of the syndrome with exposure to repetitive motion. Armstrong and Chaffin analyzed the work practices of 18 women with the carpal tunnel syndrome compared with 18 controls. While no differences in hand size were identified between the two groups, there was significantly greater hand force and frequency of pinching motions among those with the syndrome.¹³ Cannon and co-workers did a case-control study of 30 subjects in an aircraft engine assembly plant who were identified as having the carpal tunnel syndrome. Three variables were found to be predictive of the development of the carpal tunnel syndrome: using vibrating hand tools, a history of a gynecologic operation and the duration of employment. Persons with the syndrome were significantly more likely to be doing repetitive motion tasks involving the wrist.⁴ Falck and Aarnio studied 17 of a total of 20 butchers for evidence of clinical symptoms, signs or nerve conduction velocity abnormalities. Of the 85% who participated, 53% (9) had symptoms and abnormal median nerve conduction velocities consistent with carpal tunnel syndrome.⁵ While these studies support the association of the carpal tunnel syndrome with repeated wrist flexion and extension, as well as grasping, they are limited by either the lack of controls or the potential for selection bias.

That 7 of a total of 13 diagnosed cases of the syndrome occurred in a single trade, grocery checking, supports the association of the carpal tunnel syndrome with excessive workplace tasks involving repetitive motion. The cases identified represent more than 50% of the checkers who were evaluated during that period. None of the checkers had a history of rheumatoid arthritis, hypothyroidism, previous wrist fracture or the use of birth control pills. Two of them had had tubal ligations, but none reported a gynecologic operation such as an oophorectomy that might affect hormonal state.

There are several limitations to this thesis. Unlike some clusters of work-related disease where an uncommon disease presents among a small group of workers, the carpal tunnel syndrome is a common illness and grocery checking is a common occupation. For this reason, selection bias may be operating to give the appearance that an excess of the disorder is occurring when it is not. Several factors argue against this cluster being a product of selection bias. The association of the syndrome with repetitive motion is biologically plausible and it has been associated with repetitive motion in several other occupations. Finally, the onset of the symptoms in relation to work—in some, particularly with a change in work process to an electronic scanner—and the excellent response of symptoms and median sensory latencies to removal of the putative cause, repetitive motion, support the work-related nature of the illness.

The identification of this cluster of the carpal tunnel syndrome among grocery checkers is important because this disorder may lead to significant impairment and loss of livelihood and because of the large number of workers at risk. There is a need for more definitive epidemiological studies to explore further the nature and extent of the risk for the syndrome among grocery checkers. If the risk is found to be significant, these studies could be the basis for designing

checkstands that minimize the motions found to be risk factors for causing the carpal tunnel syndrome. As with all occupational diseases, preventing the disorder should remain the primary goal.

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THE CORPORATE PHYSICIAN TODAY

ALTHOUGH THE DISEASES GENERATED by work have been recorded since history's early millenia, relatively few of today's medical practitioners have knowledge of the qualifications or functions of the contemporary occupational physician. Because of legislative mandates, litigious assaults and manufacturing plant misadventures, industry and commerce, more than ever before, have had to seek skilled professional guidance in the preservation of worker health.

In light of the increasing complexity of today's technology in the manufacturing of chemicals, metals and plastics, the fabrication of computers and the use of numerical control equipment, the conduct of biomedical research and the issues involved in genetic engineering, educative and consultative assistance has been needed by industry to avoid job-generated morbidity and mortality.

With the passage of the Occupational Safety and Health Act of 1970, training programs were established and fiscally supported in a number of university-based educational resource centers. Many graduate students have completed curricula in the several disciplines composing the general arena of occupational health. Included among them have been physicians who, after a preparatory clinical year, have undertaken the rigorous programs involved in residency training in occupational medicine. Sequentially, these same physicians, following the two-year program, have met the qualifications for application and passage of the examinations required to be certified as diplomates of the American Board of Preventive Medicine in the specialty of Occupational Medicine.

How do these fully prepared physicians differ from other medical practitioners? Special skills appropriate to the identification, measure and control of the work-site hazards toxic to humankind's many bodily organ systems; the epidemiologic review of employed populations and their comprised responses to contact with work materials; the initiation and continued execution of wellness programs targeted toward the amelioration of factors placing employees at health risk; the mediation of emotional stressors; the familiarization of exposed personnel with the toxicity of contact substances, and the management of departments comprising physicians, nurses and industrial hygienists (occupational environmentalists) represent but some of the expected abilities of a physician who serves as the interpreter to executive managers of the inherent health dangers in their varied workplaces.

The corporate medical director, often a vice-president on the officer or executive ladder, has responsibilities not only for the well-being of the organization's workers, but for the notification and clarification of hazards to the transporters, users and recyclers of the company's products. Further, the medical arm of an institution must guarantee the safety of residents in the community, so that the Bhopal disaster is not replicated at other manufacturing sites. For these sophisticated and knowing actions, as founded on a broad base of clinical and research findings, the occupational physician must be uniquely prepared.

With the ever-enlarging body of toxicologic knowledge, a medical director is expected to share such knowledge with workers, supervisors and executives in a clear and understandable fashion. The transmission of factual data requires communication skills, an insight into behavior—anxiety, apprehension and fear accompany every task involving the potential compromise of health—honesty and a compassion for personnel whose truncated education or experience will prove occupationally limiting. To serve the institution well in these areas, a collateral wisdom is needed in sociology, cross-cultural differences, psychology, business and organizational theory.

Today's executive, particularly a management school graduate, wants nothing less than a highly sophisticated medical practitioner as the counselor in affairs concerning potential jeopardy of human health. Such a knowing physician is mandatory in today's complex world of industry. It is hoped that an understanding of the contemporary demands made of physicians in the corporate world will prove of interest to fellow practitioners who provide medical care to their worker-patients and their families.

JEAN SPENCER FELTON, MD
Irvine, California